VIII. *A Report of the Committee appointed by the Royal Society, to conſider of a Method for ſecuring the Powder Magazines at* Purfleet.

To the PRESIDENT and MEMBERS of the ROYAL SOCIETY.

GENTLEMEN,

THE Society being conſulted by the Board of Ordnance, on the propriety of fixing conductors for ſecuring the powder magazines at Purfleet from lightning, and having thereupon done us the honour of appointing us a committee, to conſider the ſame, and report our opinion; we have accordingly viſited thoſe buildings, and examined, with care and attention, their ſituation, conſtruction, and circumſtances, which we find as follows.

They are five in number, each about 160 feet long, and about 52 feet wide, built of brick, arched under the roof, which in one of them is ſlated, with a coping of lead 22 inches wide on the ridge from end to end; and the others, as we were informed, are

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are ſoon to be covered in the ſame manner. They ſtand parallel to each other at about 57 feet diſtance, and are founded on a chalk rock, about 100 feet from the river, which riſes in high tides within a few inches of the level of the ground, its brackiſh water alſo ſoaking through to the wells that are dug near to the buildings.

The barrels of powder, when the magazines are full, lie piled on each other up to the ſpring of the arches; and there are four copper hoops on each barrel, which, with a number of perpendicular iron bars, (that came down through the arches, to ſupport a long grooved piece of timber, wherein the crane was uſually moved and guided to any part where it was wanted) formed broken conductors within the building, the more dangerous from their being incompleat, as the exploſion from hoop to hoop, in the paſſage of lightning drawn down through the bars among the barrels, might eaſily happen to fire the powder contained in them. But the workmen were removing all thoſe iron bars (by the advice of ſome members of this Society, who had been previouſly conſulted); a meaſure we very much approve of.

On an elevated ground, nearly equal in height with the tops of the magazines, and 150 yards from them, is the houſe where the Board uſually meet. It is a lofty building, with a pointed hip-roof, the copings of lead down to the gutters, from which leaden pipes deſcend at each end of the building into the water of wells of 40 feet deep, for the purpoſe of conveying water forced up by engines to a ciſtern in in the roof. There is alſo a proof-houſe, adjoining to the end of one of the magazines, and a clock-houſe, at the diſtance of feet from them, which has a weathercock on an iron ſpindle, and, probably, ſome incompleat conductors within, ſuch as the wire uſually extending up from a clock to its hammer, the clock, pendulum, rod, &c.

The blowing up of a magazine of gun-powder by lightning, within a few years paſt, at Breſcia in Italy, which demoliſhed a conſiderable part of the town, with the loſs of many lives, does, in our opinion, ſtrongly urge the propriety of guarding ſuch magazines from that kind of danger; and ſince it is now well known, from many obſervations, that metals have the property of conducting lightning, and a method has been diſcovered of uſing that property for the ſecurity of buildings, by ſo diſpoſing and fixing iron rods, as to receive, and convey away, ſuch lightning as might otherwiſe have damaged them; which method has been practiſed near twenty years in many places, and attended with ſucceſs, in all the inſtances that have come to our knowledge, we cannot, therefore, but think it adviſeable to provide conductors of that kind for the magazines in queſtion.

In common caſes, it has been judged ſufficient, if the lower part of the conductor were ſunk three or four feet into the ground, till it came to moiſt earth; but this being a caſe of the greateſt importance, we are of opinion that greater precaution ſhould be taken. Therefore, we would adviſe, that, at each end of each magazine, a well ſhould be dug in or through the chalk, ſo deep as to have in it at leaſt four feet of ſtanding water. From the bottom of this water ſhould ariſe a piece of leaden pipe, to or near the ſurface of the ground, where it ſhould be ſtrongly joined to the end of an upright iron bar, an inch and half diameter, faſtened to the wall by leaden ſtraps, and extending ten feet above the ridge of the building, tapering from the ridge upwards to a ſharp point, the upper 12 inches of copper, the iron to be painted.

We mention lead for the under-ground part of the conductor, as leſs liable to ruſt in water and moiſt places; in the form of a pipe, as giving greater ſtiffneſs for the ſubſtance; and iron for the part above-ground, as ſtronger, and leſs likely to be cut away. The pieces, of which the bar may be compoſed, ſhould be ſcrewed ſtrongly into each other, by a cloſe joint, with a thin plate of lead between the ſhoulders, to make the joining or continuation of the metal more perfect. Each rod, in paſſing above the ridge, ſhould be ſtrongly and cloſely connected by iron or lead, or both, with the leaden coping of the roof, whereby a communication of metal will be made between the two bars of each building, for a more free and eaſy conducting of the lightning into the earth.

We alſo adviſe, in conſideration of the great length of the buildings, that two wells, of the ſame depth with the others, ſhould be dug within twelve feet of the doors of the two outſide magazines; that is to ſay, one of them on the north ſide of the north building, the other on the ſouth ſide of the ſouth building; from the bottom of which wells, ſimilar conductors ſhould be carried up to the eaves, there joining well with a plate of lead, extending on the roof up to the leaden coping of the ridge, the ſaid plate of lead being of equal ſubſtance with that of the coping.

We are further of opinion, that it will be right to form a communication of lead from the top of the chimney of the proof-houſe to the lead on its ridge, and thence to the lead on the ridge of the corridor, and thence to the iron conductor of the adjacent end of the magazine; and alſo to fix a conductor from the bottom of the weather-cock ſpindle of the clock-houſe, down on the outſide of that building, into the moiſt earth.

As to the board-houſe, we think it already well furniſhed with conductors, by the ſeveral leaden communications above-mentioned, from the point of the roof down into the water, and that, by its height and proximity, it may be ſome ſecurity to the building below it; we therefore propoſe no other conductor for that building, and only adviſe erecting a pointed iron rod on the ſummit, ſimilar to thoſe before deſcribed, and communicating with thoſe conductors.

To theſe directions we would add a çaution, that, in all future alterations or repairs of the buildings, ſpecial care be taken that the metalline communications be not cut off or removed.

It remains that we expreſs our acknowledgements to Sir Charles Frederick, Surveyor-general of the Ordnance, for the obliging attention with which he

entertained

entertained and accommodated us on the day of our enquiry.

With very great reſpect, we are,

GENTLEMEN,

Your moſt obedient,

humble ſervants,

August 21, 1772.

H. Cavendiſh,
William Watſon,
B. Franklin,
J. Robertſon.

Mr. WILSON'S *Diſſent to Part of the preceding Report.*

I Diſſent from the Report above, in that part only which recommends that each conductor ſhould terminate in a *point.*

My reaſon for diſſenting is, that ſuch conductors are, in my opinion, leſs ſafe than thoſe which are not *pointed.*

Every *point*, as ſuch, I conſider as *ſolliciting* the lightning, and, by that means, not only contributing to *increaſe* the quantity of every actual diſcharge, but alſo frequently occaſioning a diſcharge where it might not otherwiſe have happened.

If, therefore, we invite the lightning, while we are ignorant what the quantity, or the effects of it, may be, we may be *promoting* the very miſchief we mean to prevent.

Whereas if, inſtead of pointed, we make uſe of blunted conductors, thoſe will as effectually anſwer the purpoſe of conveying away the lightning *ſafely*, without that tendency to *increaſe* or *invite* it.

My further reaſons for diſapproving of *points*, in all caſes, where conductors are judged neceſſary, are contained in a letter addreſſed to the Marquis of Rockingham, and publiſhed in the Philoſophical Tranſactions, Vol. LIV. p. 247.

There are other reaſons alſo, which I have to offer, for rejecting points on this *particular occaſion*; and which, *were mentioned at the committee.* Thoſe I ſhall lay before the Royal Society at another opportunity, for the benefit of the publick.

Royal Society Houſe,
August 21, 1772.

Benj. Wilſon.

IX. *Obſer-*